



## **Pollution by Arsenic, Mercury and other Heavy Metals in Sunchulli mining district of Apolobamba (Bolivia)**

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In Bolivia, metal mining activities since historical times have been one of the most important sources of environmental pollution. This is the case of the National Area of Apolobamba Integrated Management (ANMIN of Apolobamba) in La Paz, Bolivia, where intense gold mining activities have been carried out from former times to the present, with very little gold extraction and very primitive mineral processing technology; in fact, mercury is still being used in the amalgam processes of the gold concentration, which is burned outdoors to recover the gold.

Sunchullí is a representative mining district in ANMIN of Apolobamba where mining activity is mainly gold extraction and its water effluents go to the Amazonian basin; in this mining district the productivity of extracted mineral is very low but the processes can result in heavy-metal contamination of the air, water, soils and plants. Due to its high toxicity, the contamination by arsenic and mercury create the most critical environmental problems. In addition, some other heavy metals may also be present such as lead, copper, zinc and cadmium.

These heavy metals could be incorporated in the trophic chain, through the flora and the fauna, in their bio-available and soluble forms. Inhabitants of this area consume foodcrops, fish from lakes and rivers and use the waters for the livestock, domestic use, and irrigation. The aim of this work was to evaluate the heavy metals pollution by gold mining activities in Sunchullí area.

In Sunchullí two representative zones were distinguished and sampled. Zone near the mining operation site was considered as affected by mineral extraction processes, while far away zones represented the non affected ones by the mining operation. In each zone, 3 plots were established; in each plot, 3 soil sampling points were selected in a random manner and analysed separately. In each sampling point, two samples were taken, one at the surface, from 0–5 cm depth (topsoil), and the other between 5 and 15 cm (subsurface). In addition, surface soils from mercury burn areas were also taken. Arsenic, mercury, lead, copper, zinc and cadmium total, DTPA and water extractable metals were determined.

In both zones, the results show that mining activities do not increase heavy metals levels except for arsenic (17.20 – 69.25 mg/kg) that presents high concentrations surpassing the Belgium reference levels (19.00 mg/kg), in some cases stands out the high mercury values in the affected zone (2.07 mg/kg, 1.18 mg/kg, 1.93 mg/kg). The most polluted soils are mercury burn areas with high levels of mercury (4.21 – 21.79 mg/kg) surpassing levels according to the Holland regulation (0.3 mg/kg). Workers and population are in close contact with these soils without any type of protection.